Space Weather Technical Forecast

Issued on Saturday, 08 April 2023 at 13:11 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares (R1-R2 Minor-Moderate radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with an impulsive peak flare M2.9 from AR3272 in the southeast and a number of C-flares. Slow growth is evident in this region, with flux emergence around its leader and increasing magnetic complexity due to this ongoing development. This is one of two sunspots on the disc with the other region a simpler and stable spot now approaching the southwest horizon. There are a number of filaments on the Earth-facing disc with a couple of CMEs occurring, however these were all off the Earth-Sun line. No Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar wind speed at L1 was generally at background 350-400 km/s with below average density. The total IMF, Bt, was weak, persisting below 6 nT, with the north-south component, Bz, also varying weakly between +5 and -5 nT. The Phi angle was negative (towards the Sun). Geomagnetic activity was Quiet (Kp0-2).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV), as measured at GOES16, was at background. The high energy electron flux (greater than 2MeV), as measured at GOES16 was mainly moderate, but briefly high, with a peak of 1260pfu at 08/1040 UTC. The associated 24 hour fluence was Active at first, but soon decreased to remain below this level. The 08/0000 UTC observed was 3.48e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with an ongoing chance of M-flares (R1-R2 Radio blackouts) from AR3272 in the southwest disc.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs, with the filament eruption from around 07/0800 UTC expected to miss, passing ahead and to the south of Earth on the 11th (day 4). Although there is a very slight chance of a glancing influence. Current background slow-winds are expected to persist until later on day 3 or day 4 (10-11 April), when the arrival of the fast wind associated with the HSS of CH91/+ is expected. This is likely to bring only a muted enhancement to conditions, with winds rising to 450-500km/s. Geomagnetic activity is expected to be mainly Quiet days 1-2 (8-9 Apr, with a chance of rising to Unsettled with Active periods from day 3 (10 Apr) but more likely on day 4 (11 Apr).

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at background levels. High energy (greater than 2 MeV) Electron flux will continue to be mainly Moderate with diurnal peaks of High, but with an overall declining trend. A more notable dropout is expected with the arrival of the fast winds later day 3 or day 4 (10-11 Apr). The associated 24 hour fluence is expected to remain below the Active threshold.

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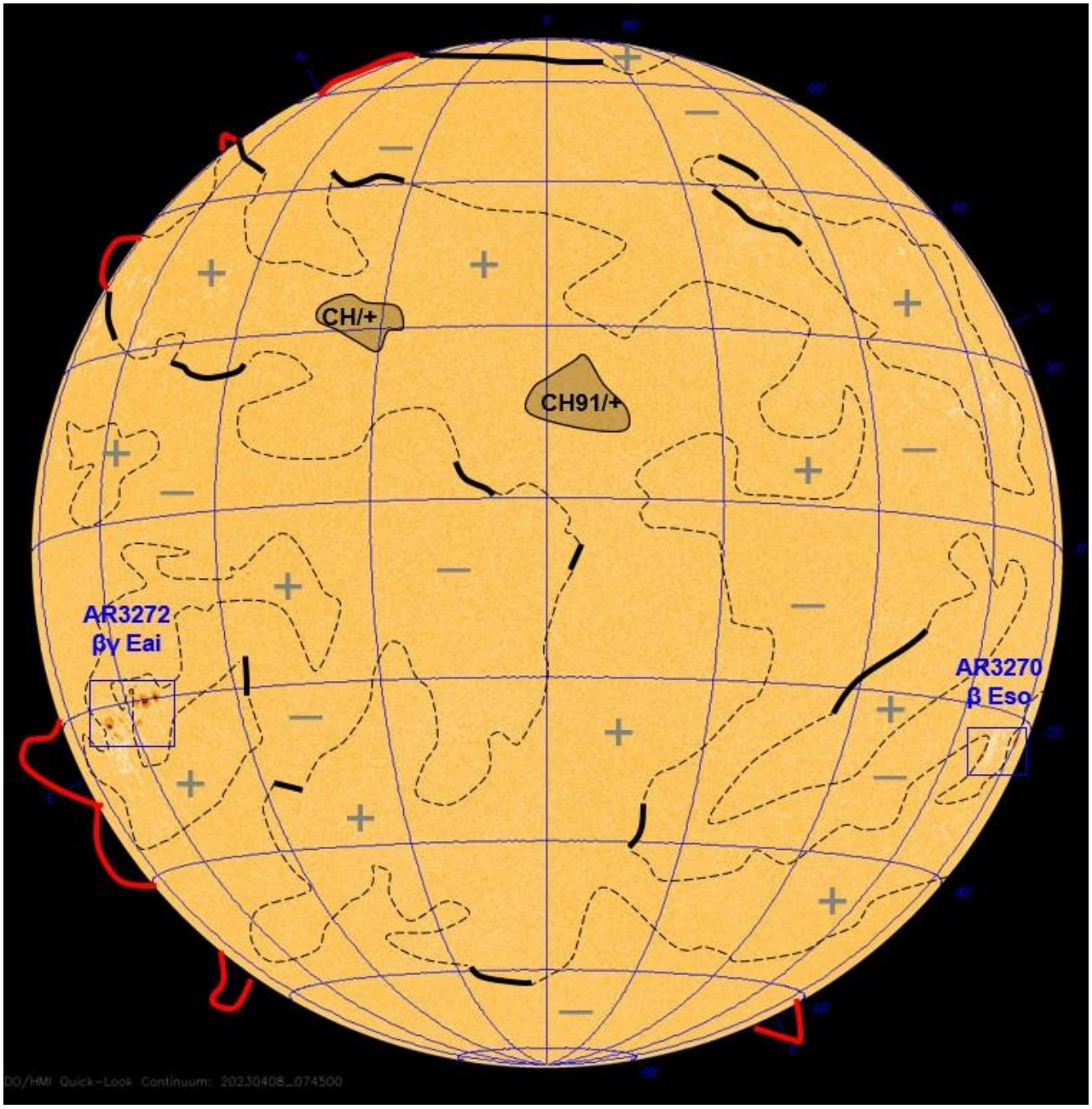
Figure 1. Solar Analysis Valid 08/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs with the previously observed filament eruption on 07 April currently expected to pass south and ahead of Earth. There is a very low likelihood of a glancing interaction, however this is unlikely to have any notable influence on the geospace environment.

Current background slow-wind conditions are expected to persist until the arrival of any fast wind associated with the high-speed stream (HSS) of CH91/+. This may begin to influence the solar wind regime as early as day 3 (10 Apr) but more likely day 4 (11 Apr), with the 27-day recurrence of this feature suggesting slightly elevated speeds of between 450-500 km/s are to be expected. However, as a positive polarity coronal hole, this is not favoured for a strong connection close to the March equinox (Russell-McPherron effect), with only relatively subdued geomagnetic activity expected.

Geomagnetic activity is expected to be mainly Quiet days 1-2, with a chance of rising to Unsettled with Active periods from day 3 (10 Apr) but more likely on day 4 (11 Apr). This includes the potential for any glancing CME interaction.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2a: Solar Wind Persistence Model. Currently good guidance, although arrival is expected to be later on this occasion. 2nd enhancement on the 11th is due to a CME on the previous rotation, so can be discounted.

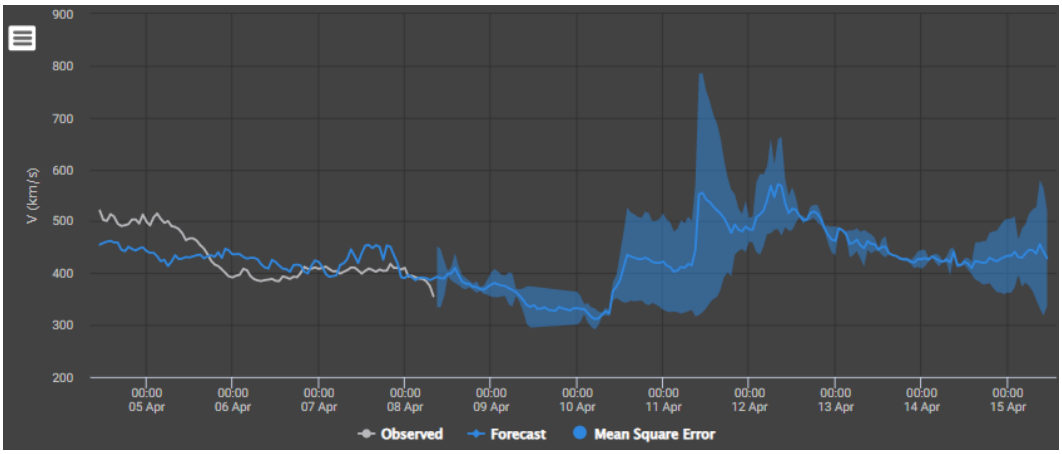

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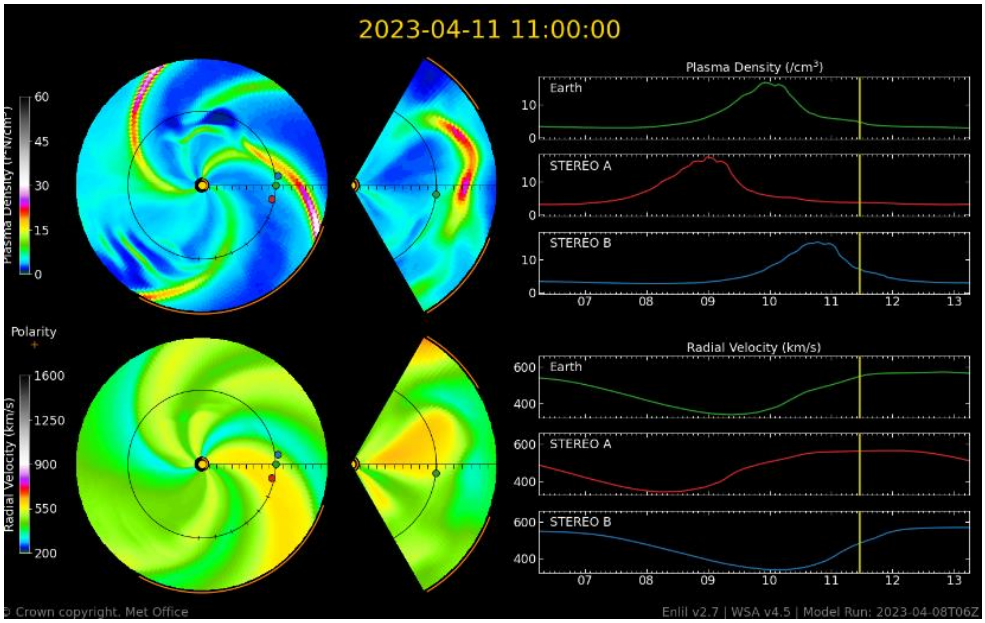
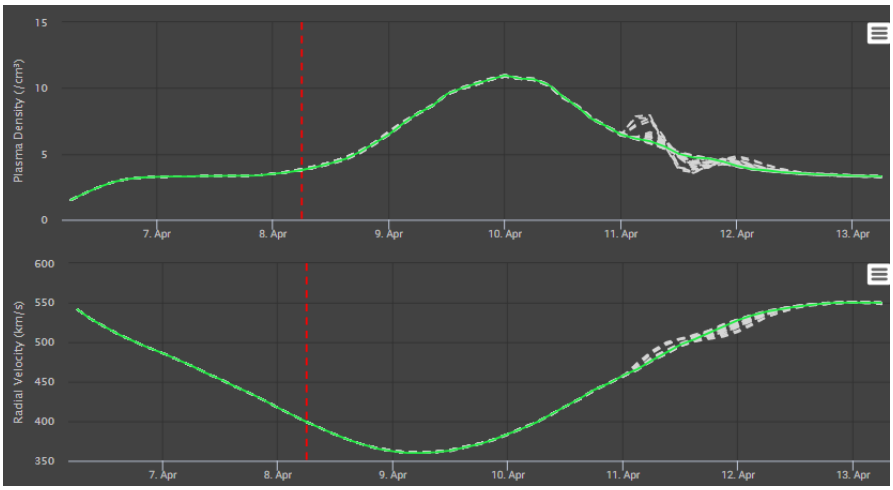
Figure 2b: Enlil and Ensemble, showing weak CME passing south but with small ensemble signal showing very slight chance of glancing interaction





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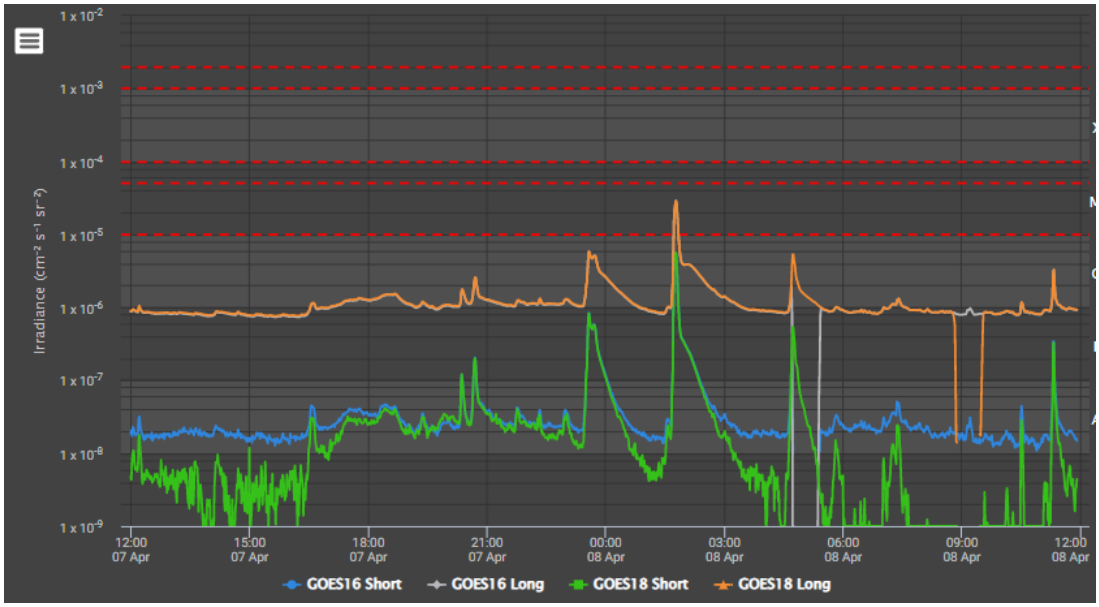
Radio Blackouts - X-Ray Flares:

Low to Moderate activity is expected with an ongoing chance of isolated M-flares, primarily due to AR3272 Eai/Beta-Gamma

AR3272 is located in the southeast and one of only two regions currently on the disc. This has a rather ragged appearance, consisting of a number of small spots but with some ongoing development evident most notably around the main negative leader, with further growth of the region is possible. This was the source of two M-flares in the last 48 hours, and further similar flares are possible. The only other region on the disc AR3270 Eso/Beta is a magnetically simple region that is now approaching the southwest limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: GOES-16/18 X-ray Flux



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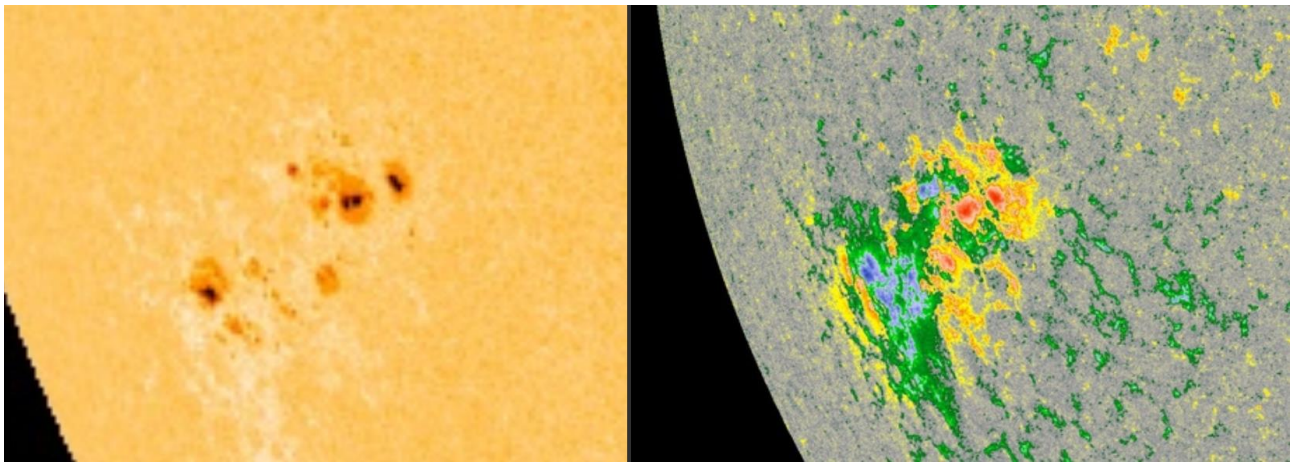
Solar Radiation Storms - (High Energy Protons):

High energy proton flux (greater than 10MeV), as observed by GOES-16, is most likely to remain at Background levels pending any significant flares, with the risks just slightly elevated by the two fairly large active regions currently on the disk.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: SDO Hmi-intensitygram (left) and Magnetogram (right) of AR3272



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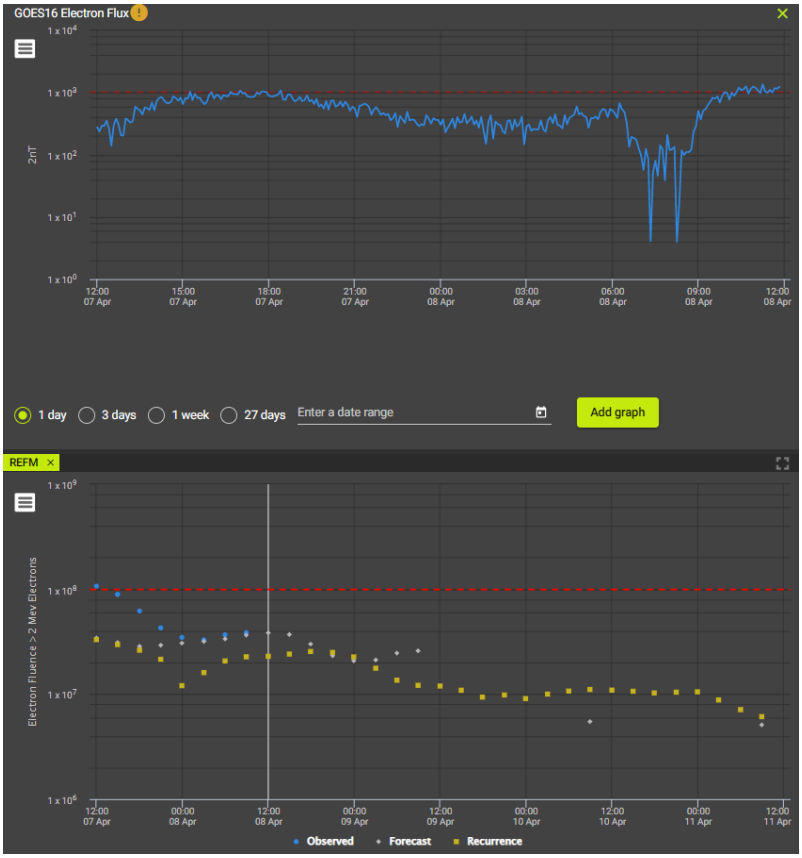
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) as observed by GOES-16 is forecast to be mainly Moderate, but likely reaching High levels at diurnal peak periods. A general but erratic declining trend is expected through the period. A more notable dropout is then expected later day 3 and into day 4 (10 and 11 Apr) due to the onset of the HSS of CH91/+.

The associated 24 hour fluence is expected to be remain below the Active threshold, and gradually declining through days 1-3 (8-10 Apr). This is supported by REFM which is currently giving good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	Yes	1	1	1	5
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: GOES-16/18 >2MeV Electron flux (top) with associated 24 hr Fluence and REFM (bottom).



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